

Message Text

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TO SECSTATE WASHDC 1409

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FOR OES/APT/SA, INR/DDR/STA
DEPT PASS TO NASA HQ, CODE I: ONR WASHINGTON

E.O. 11652: N/A
TAGS: TECH, EAIR, JA
SUBJ: DEVELOPMENT OF BLOWN-SURFACE STOL AIRCRAFT IN JAPAN

1. IN RESPONSE TO INFORMAL TASKING FROM NASA HQ AND OTHER INTERESTED GROUPS FOR INFORMATION ON POSSIBLE DEVELOPMENT OF 4-ENGINE FAN-JET UPPER-SURFACE-BLOWN STOL AIRCRAFT IN JAPAN, EMBASSY HAS LEARNED SUBSTANTIAL AMOUNT ABOUT SUCH A PROGRAM. INFORMATION WAS OBTAINED BY SENIOR SCIENTIST OF ONR TOKYO OFFICE ATTACHED TO EMBASSY: HE IS FLUID DYNAMICIST AND AERODYNAMICIST. DETAILED TECHNICAL REPORT WILL BE PREPARED FOR ONR WASHINGTON. FOLLOWING IS SUMMARY.

2. THE SCIENCE AND TECHNOLOGY AGENCY (STA) BEGAN STUDIES IN 1972 TO DETERMINE THE FEASIBILITY OF USING STOL AIRCRAFT IN COMMERCIAL DOMESTIC SERVICE. RESULTS OF THESE STUDIES PROMPTED THE NATIONAL AERONAUTICAL COUNCIL (NAC: PROF. KIMURA, CHMN.) TO PROPOSE TO THE GOJ IN 1974 THAT A FULL-SCALE STOL DEVELOPMENT PROGRAM BE CARRIED OUT. PROPOSAL WAS ACCEPTED AND NATIONAL AEROSPACE LABORATORY (NAL) BEGAN R&D IN 1975. THIS EFFORT IS SMALL BY U.S. STANDARDS, AMOUNTING TO \$5-7 MILLION EXPENDITURE OVER 1975-1980 PERIOD. FIRST PHASE OF PROGRAM CONSISTS

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OF OVERALL STUDY OF FAN-JET STOL AIRCRAFT, INCLUDING RESEARCHON

AERODYNAMIC CHARACTERISTICS AND BASIC DESIGN OF AIRCRAFT. TARGET DESIGN IS 40 METRIC TON GROSS WEIGHT VEHICLE WITH 120 SQUARE METERS OF LIFTING SURFACE, RESULTING IN WING LOADING OF 330 KILOGRAMS PER SQUARE METER. POWER TO BE DELIVERED BY FOUR FJR 1720- FAN-JET ENGINES, RATED AT 5000 THUST AT SEA LEVEL AND 1.7 TONS AT 20,000 FT. ENGINES TO HAVE BY-PASS RATIO OF 6:1. (SEE EMBASSY PREVIOUS REPORTING ON FAN-JETENGINE DEVELOPMENT IN JAPAN).

3. EXPERIMENTAL PROGRAM NOW UNDERWAY ENCOMPASSES NOISE ABATEMENT STUDIES ON HIGH LIFT DEVICES AND FLIGHT TESTS WITH VARIABLE STABILITY AIRCRAFT: LATTER ARE MODIFIED SMALL COMMERCIAL AIRCRAFT, AID TO BE A JAPANESE FUJI AND/OR AN AMERICAN BEECHCRAFT. DEVELOPMENT AND TEST OF ENGINE SYSTEMS, CONTROL SYSTEMS, AND AIRFRAME STRUCTURE WILL BE STARTED IN 1978 BY NAL.

4. ALSO STARTING IN 1978, NAL AND ELECTRONIC NAVIGATION RESEARCH INSTITUTE (ENRI) ARE TO STUDY FLIGHT TEST METHODS FOR THE FIRST STOL RESEARCH PROTOTYPE, DESIGN, MANUFACTURING, ASSEMBLY AND FLIGHT TEST OF WHICH WILL ALSO BEGIN IN 1978 AND EXTEND THROUGH 1983. THIS WILL BE SEPARATELY FUNDED PROGRAM ESTIMATED TO COST \$55 MILLION. CONTRACTOR FOR AIRCRAFT NOT YET SELECTED. DEVELOPMENT OF COMMERCIAL PROTOTYPE IS SCHEDULED TO BE PHASED INTO RESEARCH PROTOTYPE PROGRAM STARTING IN 1981 AND EXTENDING THROUGH 1985: MITI WILL FUND COMMERCIAL PROTOTYPE EFFORT IN ALL PROBABILITY. MINISTRY OF TRANSPORT (MOT) WILL SPONSOR PARALLEL DEVELOPMENT OF COMMERCIAL NAVIGATION SYSTEM.

5. ALTHOUGH ABOVE INFORMATION ON SCHEDULE IMPLIES THAT EXPERIMENTAL PROGRAM IS IN EARLY STAGE, IN ACTUALITY NAL HAS BEEN CONDUCTING RESEARCH FOR SEVERAL YEARS AND AT LEAST TWO JAPANESE AIRCRAFT MANUFACTURERS HAVE BUILT PLANES INCORPORATING BLOWN-SURFACE LIFTING PRINCIPLES TO ENHANCE STOL CAPABILITY (SEE BELOW). AT NAL, SHUN TAKEDA WAS IN CHARGE OF STOL DEVELOPMENT BUT HE WAS RECENTLY PROMOTED TO VICE DIRECTOR OF LABORATORY. N. INUMARU IS NOW IN OVERALL CHARGE OF VTOL/STOL RESEARCH, AND G. BEPPU DIRECTS FLIGHT RESEARCH. IN 1974, NAL BEGAN SMALL WIND TUNNEL EXPERIMENTS ON UPPER-SURFACE-BLOWN AIRFOILS AT LIMITED OFFICIAL USE

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MAXIMUM AIR VELOCITY OF 67 METERS PER SEC IN TUNNEL CROSS-SECTION OF 2 METERS BY 2 METERS. A SEMI-ANECHOIC CHAMBER IS NOW BEING DESIGNED TO BE PLACED AROUND THE WORKING SECTION OF THE TUNNEL SO THAT NOISE GENERATION CAN BE MEASURED. (ONR SCIENTIST IS OF IMPRESSION THAT JAPANESE ARE NOT PARTICULARLY ADEPT AT NOISE ABATEMENT WORK). ONE OF MAJOR IMPERATIVES OF STOL DESIGN WORK WILL BE TO REDUCE NOISE LEVEL OF THIS INHERENTLY NOISY TYPE OF AIRCRAFT TO LEVEL EQUAL TO OR LOWER

THAN EXISTING COMMERCIAL AIRCRAFT SUCH AS FS-11, BOEING 727/737, ETC. WIND TUNNEL IS LOCATED AT CHOFU AIRPORT NEAR TOKYO. ONE-TENTH SCALE MODEL TESTS ALSO HAVE BEEN CONDUCTED AT A WIND TUNNEL AT NAL'S MAJOR LAB IN MITAKA: PURPOSE ALSO WAS TO MAKE NOISE MEASUREMENTS. BASED ON EXPERIENCE ALREADY GAINED IN SURFACE BLOWING OF A LARGE QUASI-MILITARY AMPHIBIAN AIRCRAFT, NAL IS ALSO BUILDING AN OPEN-AIR GROUND TEST FACILITY AT KAKUTA NEAR SENDAI FOR EVALUATING ENGINE/NACELLE COMBINATIONS. NACELLE DESIGN IS CRITICAL. AT LOW LANDING AND TAKE-OFF SPEEDS, STOL IS SUBJECT TO SEVERE SIDESLIPPING DUE TO TORQUE OF ENGINES AND MARGINAL FLIGHT STABILITY. SIDESLIPPING CAN BE COUNTERED BY PROPER AERODYNAMIC DESIGN OF NACELLES. AN FJR-1710/10 FAN-JET ENGINE MANUFACTURED BY IHI WILL BE USED IN GROUND TEST FACILITY.

6. CARBON FIBER REINFORCED PLASTICS (CFRP) ARE BEING TESTED AS STRUCTURAL MATERIAL FOR LIFT AND CONTROL SURFACES, PARTICULARLY TAIL STRUCTURE. AT THIS TIME NAL HAS NOT YET DECIDED WHETHER ELEVATOR SURFACES WILL BE BLOWN, WITH CHANCES NOW BEING ABOUT 50/50. AS FAR AS LIFT SURFACES ARE CONCERNED, CONFIGURATIONS FOR SURFACE BLOWING THAT HAVE BEEN STUDIED INCLUDE (A) FLAPS ONLY, (B) FLAPS AND LEADING EDGE SLOTS, AND (C) BOUNDARY LAYER CONTROL. ALSO, SUCTION RATHER THAN PRESSURE TO DRAW AIR OVER SURFACES HAS BEEN STUDIED BUT REJECTED. IN ONE ATTEMPT TO EQUIP A SMALL FUJI AIRCRAFT WITH A BLOWN WING, ANGLE OF ATTACK OF AIRCRAFT AT LANDING WAS TOO LARGE, RESULTING IN TAIL SKID TOUCHING GROUND BEFORE WHEELS. THIS EFFECT CAN BE COMPENSATED FOR BY BLOWING ELEVATOR SURFACES.

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7. PRIVATE COMPANY WHICH APPEARS TO BE ACTIVELY SEEKING STOL CONTRACT FROM STA OR MITI IS SHINMEIWA INDUSTRY, LOCATED IN KOBE. COMPANY WAS ALSO VISITED BY ONR SCIENTIST. SHINMEIWA IS NOT CURRENTLY A LARGE MANUFACTURER OF AIRCRAFT, BUT PRODUCED MORE THAN 2,000 MILITARY PLANES DURING WW II. WE HAVE BEEN TOLD THAT THIS COMPANY WAS GIVEN CONTRACT BY ONR IN 1961 TO REBUILD US AIRCRAFT UFX-5 SO THAT IT COULD BE TESTED WITH BOUNDARY LAYER CONTROL.

8. SHINMEIWA IS MANUFACTURER OF PS-1 AND US-1 STOL AIRCRAFT BEING SOLD TO GOJ MARITIME SELF DEFENSE FORCE. 1975 EDITION OF JAPANESE HANDBOOK, "WORLD AIRCRAFT ANNUAL" (SEKAI KOKUKI NENKAN), TOGETHER WITH INFO FROM SHINMEIWA ENGINEERS, GIVES FOLLOWING PICTURE OF THESE AIRCRAFT. PS-1 IS PATROL SEAPLANE CAPABLE OF TAKE-OFFS AND LANDING IN SEAS WITH 3-METER WAVE HEIGHT, AND AT 25 METER/SEC WIND VELOCITY, DUE TO STOL DESIGN (LANDING SPEED 49 KNOTS, STALL SPEED 40 KNOTS). HULL HAS ANTI-SPRAY SKIRT TO REDUCE EFFECT OF ROUGH -WATER OPERATIONS. FOR STOL, INNER AND OUTER WING FLAPS ARE USED, TOGETHER WITH BLOWN BOUNDARY LAYER CONTROL. ELEVATOR AND RUDDER ARE BLOWN ALSO: ELEVATOR IS BLOWN TO KEEP THE TAIL DOWN, AND RUDDER IS BLOWN TO COMPENSATE FOR SIDESLIP. UPPER SURFACE OF ELEVATOR HAS NEGATIVE CAMBER. MAXIMUM LIFT FACTOR IS 7. PROPULSION POWER COMES FROM 4 GE T-64 TURBOJET ENGINES RATED AT 2785 EHP. SURFACE BLOWING IS PROVIDED BY GE T-58 ENGINE RATED AT 1250 EHP,
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INTERNALLY MOUNTED AND DUCTED TO SURFACES. ONE-MILLIMETER SLOTS ALONG BLOWN SURFACES PROVIDE AIR AT 1.6 TO 1.8 ATMOSPHERES PRESSURE. BOTH KINDS OF ENGINES ARE MANUFACTURED BY IHI UNDER GE LICENSE. MINIMUM TAXIING DISTANCES ARE 295 METERS FOR TAKEOFF, 240 METERS FOR LANDING. U.S. NAVY AT IWAKUNI IS REPORTED TO HAVE BOUGHT ONE PS-2 FOR TEST. GOJ MARITIME SELF DEFENSE FORCE APPARENTLY USES PS-1 FOR LAYING DOWN ASW CABLE ARRAYS BY SURFACE "TRAWLING" AT 3 KNOTS. SHINMEIWA IS TRYING TO SELL PS-1 AS FIREFIGHTING AIRCRAFT: IT CAN TRANSPORT 16 TONS OF WATER FOR THIS PURPOSE.

9. US-1 AIRCRAFT IS AMPHIBIOUS VERSION OF PS-1 AND IS INTENDED FOR USE AS RESCUE PLANE. JAPANESE HANDBOOK DOES NOT SHOW THAT US-1 IS EQUIPPED WITH FIFTH ENGINE FOR BLOWING. AIRCRAFT REQUIRES 265 METERS FOR TAKEOFF FROM WATER, 610 METERS FOR TAKEOFF FROM RUNWAY, AND 899 METERS FOR LANDING ON WATER.

10. SECOND COMPANY WITH STOL INTERESTS IS KAWASAKI HEAVY INDUSTRIES. THIS COMPANY MANUFACTURES C-1 MILITARY TRANSPORT, A HIGH-WING AIRCRAFT EQUIPPED WITH TWO P&W JT-8 D-9 TURBOFAN

ENGINES, RATED AT 6,575 KG THRUST. MOST OTHER JAPANESE AIRCRAFT COMPANIES ARE SUBCONTRACTORS. STOL PERFORMANCE IS ACHIEVED WITH LEADING EDGE SLATS AND FOULER FLAPS. PLANE IS DESIGNED TO BE COMPATIBLE IN LOAD CHARACTERISTICS WITH USAF 463L. DESIGN LIFT FACTOR IS 3. TAXIING DISTANCES ARE 670 METERS FOR TAKEOFF, 370 METERS FOR LANDING (WITH THRUST REVERSAL).

11. RETIRED NASA/AMES ENGINEER NOW WORKING ON SHORT-TERM ASSIGNMENT AT NAL IN MITAKA HAS TOLD SCICOUNS THAT FURTHER MODIFICATIONS TO C-1 (ACTUALLY TO XC-1 TEST PROTOTYPE) ARE BEING STUDIED TO INCREASE STOL CAPABILITY. BOEING AND NASA AMES ARE SAID TO BE INVOLVED IN STUDIES. PROGRAM IS TO LAST FOUR YEARS AND TO HAVE OBJECTIVE OF BEING ABLE TO MODIFY AIRCRAFT FOR COST OF \$50,000 DOLLAR FIGURE APPEARS UNREASONABLE AND MAY BE XYSIONLUXNKQ URMGS.## ENGINEER HAS OBTAINED TWO REPORTS IN

JAPANESE ON STOL DEVELOPMENT EMBASSY WILL ARRANGE TO HAVE REPORTS TRANSLATED AND SENT TO WASHINGTON.

12. IF ANY OF ABOVE IS OF PARTICULAR INTEREST TO NASA OR OTHERS, FURTHER DETAILS CAN BE OBTAINED.
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SHOESMITH

NOTE BY OC/T: PARA 11 (##)TEXT AS RECEIVED.

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Message Attributes

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